Two new species *Bicoxidens* Attems, 1928, from Zimbabwe (Diplopoda: Spirostreptida: Spirostreptidae)

T. Mwabvu

Biological Sciences Department, University of Zimbabwe, P.O. Box MP 167, Mount Pleasant, Harare, Zimbabwe. E-mail: mwabvu@compcentre.uz.ac.zw

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***Bicoxidens nasti* n.sp. and *Bicoxidens friendi* n.sp. are described from five and six males, respectively. *B. nasti* was collected from miombo woodland litter west of Marondera, Mashonaland East, whereas *B. friendi* was collected in grasses on a granite rock outcrop at Mutawatawa Growth Point in Maramba district, Murewa, northeast of Harare. *B. nasti* differs from all other species of *Bicoxidens* by the presence of a hammer-shaped mesad process on each paracoxite and a long sickle-shaped mesad process on the telocoxite, which completely overlaps with that of the opposite gonopod. *B. friendi* differs by having three median processes on the telocoxite giving the gonopod a T-shape.**

Key words: millipede, gonopods, paracoxite, taxonomy.

INTRODUCTION

The two new species of *Bicoxidens* described here are part of a collection in the University of Zimbabwe's Biological Sciences Museum, following an extensive collection of spirostreptid millipedes in Zimbabwe between 1995 and 1998 by the author.

Attems (1928) described the genus *Bicoxidens* and two species, *B. nigerrimus* and *B. flavicollis*. Three additional *Bicoxidens* species have since been described: *B. grandis* Lawrence, 1965, from Birchenough Bridge, Zimbabwe; *B. matabele* Schubart, 1966, from West Nicholson, Zimbabwe, and *B. brincki* Schubart, 1966, from the Kruger National Park, South Africa. Specimens of *B. brincki* have also been collected near Beitbridge in Zimbabwe.

Species of *Bicoxidens* differ slightly in colour. Various shades of black appear to be the common body colours in this genus. However orange-brown specimens have also been collected. Length ranges from 75–110 mm, diameter from 6.6–10.6 mm and number of segments from 54–61.

The anterior gonopods (telocoxites) of *Bicoxidens* species show the most pronounced differences in size, shape, the number of lateral lobes and their extent of overlap.

The posterior gonopods (telopodite) of *Bicoxidens* species are similar but differ towards the extremity where the size of the spines, rounded lobes and the extent of looping differ.

The two new species, *B. friendi* and *B. nasti,* are compared with the other six valid members of the genus, from which they differ in many aspects.

***Bicoxidens friendi* n.sp.**, Figs 1–5, 11

Type material

Male holotype (UZ/TM150) collected at Mutawatawa (17°20′S, 31°95′E), Maramba district, Murewa, northeast of Harare, Zimbabwe, 21 December 1996, by T. Mwabvu. Paratypes: five males with same data as holotype. Holotype and two paratypes in the Biological Sciences Department Museum, University of Zimbabwe, two paratype males in the Natural History Museum, Bulawayo, Zimbabwe, and one paratype male in the Zoological Museum, Copenhagen, Denmark.

Etymology

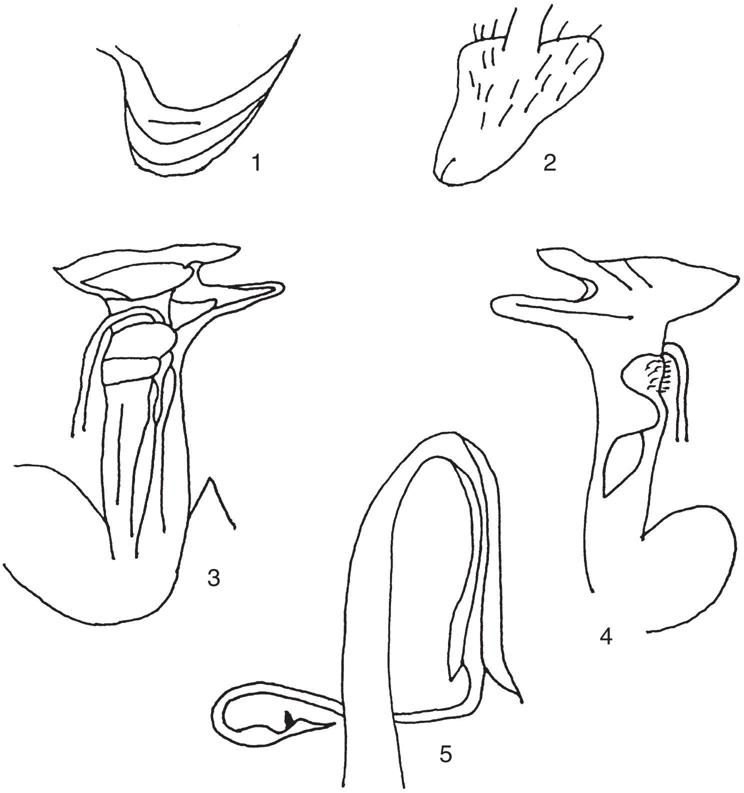
The species is so named because it is not odorous.

Diagnosis

A species of *Bicoxidens* differing from congeneric species by having a T-shaped gonopod with three median processes pointing inward and another pointing outward forming a flat roof. The larger of the three processes overlaps with that from the opposite gonopod, the smallest process is only visible orally.

Description of holotype

Body colour greenish-black, legs and antennae reddish-brown. Length 92 mm, minimum and



Figs 1–5. *Bicoxidens friendi* n.sp. **1**, collum of male; **2**, left prefemoral lobe of first male leg pair, oral aspect; **3**, left gonopod, oral aspect; **4**, left gonopod aboral aspect; **5**, telopodite, greatly enlarged.

maximum horizontal diameter 6.8 mm and 7.8 mm, respectively; 54 (podous segments) + 0 (apodous segments) + T (telson) body rings. Antennae 6 mm long, extending posteriorly to the third body ring. Eyes triangular, 0.57 times as wide as the distance between them; 15 rows of ocelli. Collum with broad rounded lateral lobes, each lobe with three complete striae and an incomplete stria below the topmost complete one (Fig. 1). Leg 6 mm (76 % of maximum horizontal diameter). Three rows of sigilla on metazona of mid-body rings; striae on metazona dense, striation extending to well above ozopore level, striae above ozopores very abbreviated. Limbus with straight edge. Preanal ring dorsally not extending beyond anal valves. Each anal valve with a broad shallow submarginal groove and a narrower marginal groove.

Male sexual characters

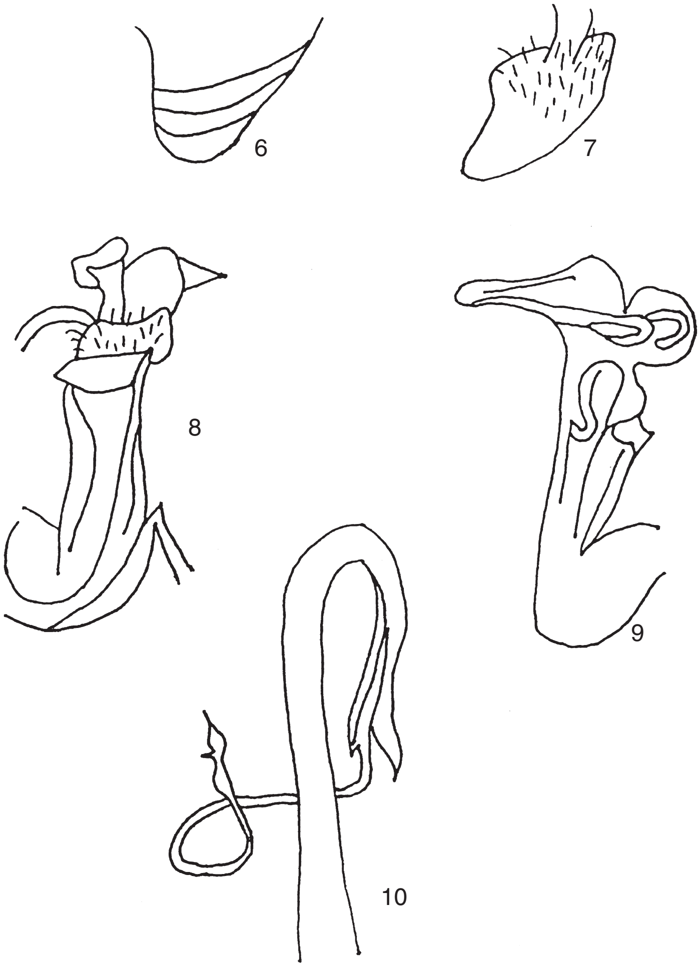
First pair of legs with rounded prefemoral lobes (Fig. 2). Legs without ventral pads on podomeres.

Gonopod T-shaped. Sternum arrowhead-shaped (Fig. 3). Lateral coxal fold apically rounded, setose, subapically with subspherical swelling. Telocoxite with three median processes (Fig. 3) pointing mesad and one process pointing laterad, apically almost forming a flat roof, giving the gonopod its distinct T-shape. Two large mesad processes separated by U-shaped incision; the longest mesad process overlapping with that from opposite gonopod, the shortest only visible in oral view. Aborally there is a large pear-shaped swelling (Fig. 4). Telopodite simple, slender, cylindrical, acutely bent at exit from gonocoel. Free part abruptly narrowed at approximately mid-length, with two short, pointed processes at narrowing point; tip of telopodite forming an incomplete circular loop, with a lateral bulb-like extension and a pointed side branch (Fig. 5).

***Bicoxidens nasti* n.sp.**, Figs 6–10, 11

Type material

Male holotype (UZ/TM249) collected west of Marondera town (18°25′S, 31°65′E), southeast of



Figs 6–10. *Bicoxidens nasti* n.sp. **6**, collum of male; **7**, left prefemoral lobe of first male leg pair; **8**, left gonopod, oral aspect; **9**, left gonopod, aboral aspect; **10**, telopodite, greatly enlarged.

Harare, Zimbabwe, 16 January 1996, by T. Mwabvu. Paratypes: four males with same data as holotype. Holotype and one paratype in the Biological Sciences Department Museum, University of Zimbabwe, two paratype males in the Natural History Museum, Bulawayo, Zimbabwe, and one paratype male in the Zoological Museum, Copenhagen, Denmark.

Etymology

The species is so named because it is odorous.

Diagnosis

Bicoxidens nasti is easily distinguished from other species of *Bicoxidens* by a hammer-shaped mesad process apically on each paracoxite and a sickle-shaped mesad process on each telocoxite completely overlapping the other, forming a shallow arc aborally.

Description of holotype

Length 95 mm, minimum and maximum horizontal diameter 6.6 and 7.5 mm, respectively; 55 (podous segments) + 0 (apodous segments) + T (telson) body rings. Body, antennae and legs black. Antennae 6 mm long, reaching back to the third ring. Eyes triangular, 0.67 times as wide as the distance between them; 16 rows of ocelli. Collum with a rounded lateral lobes, each lobe with three complete striae (Fig. 6). Leg length is 66 % of maximum body diameter. Two rows of sigilla on metazona of mid-body segment; striae on metazona closely packed. Limbus with straight edge. Preanal ring dorsally not extending beyond anal

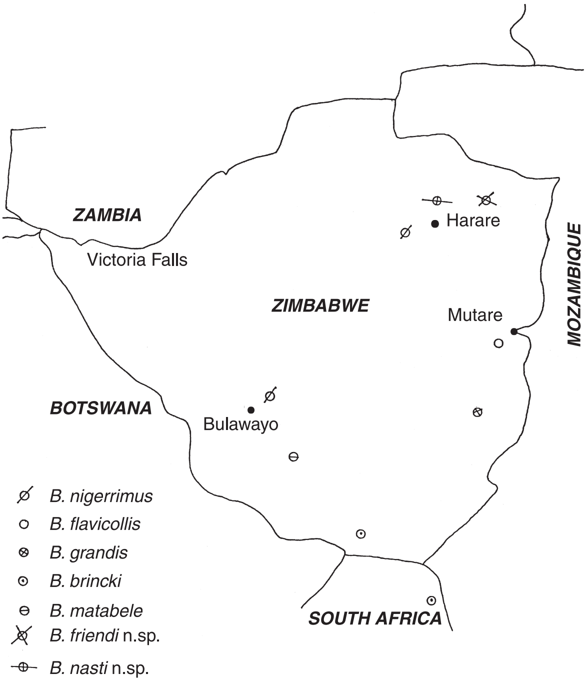


Fig. 11. Distribution of *Bicoxidens* species in southern Africa.

valves. Each anal valve with a broad, shallow submarginal groove and a narrower marginal groove.

Male sexual characters

First pair of legs with rounded prefemoral lobes directed outwards laterally (Fig. 7). Legs without ventral pads on podomeres. Sternum arrowhead-shaped (Fig. 8). Paracoxite on the lateral lamella apically with hammer-shaped mesad processes. Telocoxite with two apical extensions and a long sickle-shaped mesad process which overlaps completely with that of opposite gonopod, forming a shallow arc aborally (Fig. 8). Small sclerotized, rounded lobe mid-length aborally (Fig. 9). Telopodite simple, slender, cylindrical and with no spines; acutely bent at exit from gonocoel. Telopodite abruptly narrowed mid-length; two small and opposite processes at narrowing point; apically forming a complete circular loop with a bulb-like extension and a pointed side branch (Fig. 10).

Key to the species of *Bicoxidens* in southern Africa

- Inwardly directed lobe at extremity of gonopod coxite short, rounded and not crossed by lobe of opposite side . . *B. nigerrimus*
- Lobe of gonopod coxite very long and slender, crossing lobe from the opposite side . . . . *B. flavicollis*
- Telocoxite birds'-head in appearance, emphasized by a pointed beak-like extension . . . . *B. brincki*
- Telocoxite with two separate humps, an outwardly-directed lateral cone and aborally an inwardly-directed, horizontal, curved extension. . . . . *B. matebele*
- Telocoxite with an outwardly-directed lobe, another inwardly directed, pointing downwards and yet overlapping with theopposite lobe . . . . *B. grandis*
- Hammer-shaped mesad processes on paracoxite; telocoxite with sickle-shaped mesad process; telopodite forms complete loop towards extremity. . . . . *B. nasti*
- Gonopod T-shaped; telocoxite with three median processes, the shortest visible orally; telopodite forms incomplete loop towards extremity . . . . *B. friendi*

Bicoxidens polyptychus Kraus, 1958, found in eastern Katanga (Zaire) appears to be isolated, considering that other congeneric species occur only in southern Africa. Drawings and descriptions of the gonopods of this species are unclear, it was therefore not included in the key.

DISCUSSION

There is no doubt that *B. nasti* and *B. friendi* belong to this genus. Their morphology agrees with the diagnosis of *Bicoxidens* provided by Attems (1928).

The black body-colour of *B. nasti* n.sp. resembles that of *B. nigerrimus, grandis* and *B. brincki*. The number of segments also overlaps that of *B. flavicollis*, *B. brincki* and *B. nigerrimus.*

The telocoxite of *B. nasti* differs from that of other species of *Bicoxidens* except for the overlap of opposite processes that may be on the telocoxite. The paracoxite differs in having a hammer-shaped process apically. The telopodite bears two processes on either side just before the curve, resembling *B. nigerrimus* more than the other species that have one developed spine and an opposite lobe. Distal to the processes, the telopodite resembles that of *B. nigerrimus, B. grandis* and *B. flavicollis* in having a rounded lobe towards the tip.

Bicoxidens friendi resembles *B. flavicollis* in colour. The body is greenish-black with brownish legs, unlike other species that are black or black-brown. *B. friendi* is less robust than *B. matebele, B. grandis* and *B. brincki*, but resembles *B. flavicollis* and *B. nigerrimus* in size. The anterior gonopod does not resemble congeneric species other than some overlap between lateral processes from opposite gonopods. The telopodite is generally similar to that of other *Bicoxidens* species but more so to *B. flavicollis*.

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REFERENCES

ATTEMS, C. 1928. The Myriapoda of southern Africa. *Annals of the South African Museum* **26**: 329–331.

LAWRENCE, R.F. 1965. New Spirostreptidae and Harpagophoridae (Diplopoda) from southern Africa. *Memórias do Instituto de investigaçao cientifica de Moçambique Serie A* **7**: 38–39.

SCHUBART, V.O. 1966. Diplopoda III: Pselaphognatha, Opisthospermophora, Colobognatha. In: *South African Animal Life,* (eds) B. Hanström, P. Brinck & G. Rudebeck **12**: 86–89, 118–120. Stockholm, Almqvist & Wilksell.